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Transfer of environmentally sound technologies, cooperation and capacity-building

Report of the Secretary-General

SUMMARY

The present report covers the three priority areas identified by the Commission on Sustainable Development for which specific action is necessary: (a) access to and dissemination of information on environmentally sound technologies; (b) institutional development and capacity-building for managing technological change; and (c) financial and partnership arrangements. Emphasis is given to experiences gained and lessons learned by national Governments, international organizations and the private sector in implementing policies and programmes related to these priority areas. It is suggested that there is a need for the Commission to move forward in the development and implementation of a work programme on transfer of environmentally sound technology, cooperation and capacity-building that would encourage and support efforts at the national level to promote environmentally sound technologies for sustainable development.

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INTRODUCTION

1. At its second session, held from 16 to 27 May 1994 in New York, the Commission on Sustainable Development adopted a decision entitled "Transfer of environmentally sound technology, cooperation and capacity-building". 1/ In that decision, the Commission stressed the need for Governments of developed and developing countries and countries with economies in transition to take specific action in the following three interlinked priority areas:

(a) Access to and dissemination of information on environmentally sound technologies;

(b) Institutional development and capacity-building for managing technological change;

(c) Financial and partnership arrangements.

2. The present report focuses on these three areas, with emphasis on experiences gained and lessons learned by national Governments, international organizations and the private sector in implementing policies and programmes related to the development, transfer and diffusion of environmentally sound technologies (ESTs). Several policy recommendations are presented for each of the three priority areas.

3. Based on these recommendations, Elements of a work programme are presented composed of activities suggested for use at the country level by national Governments, and by (or with the support of) the United Nations system, other intergovernmental organizations and the private sector. To encourage and support national efforts to promote ESTs for sustainable development, the Commission will need to move forward in the development and implementation of a work programme on EST transfer, cooperation and capacity-building, with the objective of having it fully operational by 1997.

4. The preparation of this report benefited from inter-sessional meetings, including the OECD Workshop on Development Assistance and Technology Cooperation for Cleaner Production in Developing Countries (Hanover Workshop), Hanover, 28-30 September 1994; the Government of Poland's Third High-Level Advisory Seminar on Cleaner Production (Warsaw Seminar), Warsaw, 11-14 October 1994; the Workshop on Access to and Dissemination of Information on Environmentally Sound Technologies (Seoul Workshop), held by the Government of the Republic of Korea, Seoul, 30 November-2 December 1994; and a Round Table on Technology Transfer, Cooperation and Capacity-Building (Vienna Round Table), organized by the United Nations Industrial Development Organization (UNIDO), in cooperation with the United Nations Environment Programme (UNEP) and the Department for Policy Coordination and Sustainable Development of the United Nations Secretariat, Vienna, 6-8 February 1995.

5. Extensive use was made of information provided by Governments, the United Nations system and other intergovernmental organizations, as well as contributions submitted by the private sector and other major groups.

6. A "Compilation of information on policies and programmes of countries, international organizations and financial institutions to promote the transfer of environmentally sound technology, cooperation and capacity-building" is submitted as an addendum to this report. The purpose of this compilation is to provide, based on available information, an overview on initiatives being undertaken by countries, the United Nations system, other international organizations and the private sector to promote environmentally sound technology transfer, cooperation and capacity-building. The compilation is based on information submitted by national Governments to the Commission as well as on that provided by national and international organizations, financial institutions and the private sector. It also draws upon the contributions made available to the various inter-sessional meetings. The structure of the compilation resembles, in general, that of this report.

I. CURRENT SITUATION AND TRENDS RELATED TO THE TRANSFER OF ENVIRONMENTALLY SOUND TECHNOLOGIES

7. Technology transfer is a process involving the raising of awareness of the benefits of ESTs so as to create the demand for these technologies, the obtaining of information and the making of assessments of available and accessible technological options, and the implementing of technology selection and the managing of technological change. If any of these elements is omitted or seriously deficient, successful technology transfer will be difficult. The above implies transfer of hardware and services, of skills for operating and maintaining technology, and of technological capacity to adapt, incorporate and upgrade technology. 2/

8. Policies and programmes at the national and international levels to promote the development, transfer and diffusion of ESTs are increasingly being guided by two criteria: (a) a more reasonable balance between economic growth and environmental protection; and (b) a shift of focus from end-of-pipe technologies to cleaner production processes. In shifting to preventive approaches to environmental protection, many developed and developing countries and economies in transition have introduced or are considering cleaner production programmes.

Box 1. Environmental industry shift in focus

"Regulations, economics and common sense continue to shift the focus of the environmental industry more and more away from waste treatment and control to waste reduction and prevention. This broadening and redefinition of the industry is reflected by current corporate interest in concepts like strategic environmental management and 'industrial ecology', and the growing industrial focus on design for the environment (DFE) and design for disassembly (DFD) manufacturing techniques. We are witnessing a true sea change in industry's approach to the environment, and it will continue to reverberate through the commercial environmental industry for the next several years. In the process it will transform business as we know it. Many sectors of the original 'haul and dump' waste disposal business - the original environmental business - will be increasingly rendered a thing of the past as environmental practices evolve, giving rise to a new 'industry' focused more on recovery and prevention services."

Source: TechKNOWLEDGEy Strategic Group, 1994.

9. The quotation contained in box 1 implies a gradual change of focus regarding the demand for ESTs compared with other technologies, in general, and for cleaner production versus pollution control technologies, in particular. ESTs comprise both cleaner production technologies and pollution control technologies and both types are complementary technological solutions that have a role to play in moving towards more environment-friendly development.

10. In discussing the possible options for converting to cleaner production, the position of the pollution control technology industry in the market has to be considered. The Organisation for Economic Cooperation and Development (OECD) has estimated the size of the pollution control technology industry at US$ 200-300 billion per year. According to one OECD document, "in many cases, firms may invest in either end-of-pipe, pollution control and waste management technologies or cleaner production technologies. The demand for cleaner production technologies may be sharply limited by the relative advantages of the conventional and well-established pollution control technology industries over the emergent cleaner production technology industry". 3/ In addition, the Third High-Level Advisory Seminar on Cleaner Production noted that some existing macroeconomic policies (for example, subsidies, pricing of raw materials and energy) impede the demand for cleaner production and act as disincentives to its use. 4/

11. While the transfer of ESTs is effected primarily through private transactions, the scope and speed of this transfer are directly related to the creation of an "enabling" environment that is of common interest to all parties involved in the transfer process. It requires the setting up of a legal and economic framework with a practical system of environmental regulations, enforcement mechanisms and economic and fiscal incentives.

12. Although the main impact of policies has been through environmental regulations and standards, there has been a shift in focus towards policy

instruments, in particular economic instruments, incentives and voluntary agreements, that concentrate more on outcomes, and provide greater flexibility in achieving environmentally satisfactory solutions. This shift has been coupled with a greater emphasis on clean technologies and products. Both trends provide new impetus to the industry. 5/

13. The Vienna Round Table noted that the formulation of policy instruments, in particular economic instruments, could be a fruitful subject for international cooperation, in so far as there was a need to exchange experiences on the utilization of various policy instruments; that there was an overarching need to provide incentives to the transfer and deployment of ESTs as against the establishment of disincentives to environmental degradation; and that new concepts of quality management needed to be explored to promote the use of ESTs and management practices. 6/

14. Fostering investments in ESTs also requires the adoption of favourable policies for business development, and, in addition, the creation of a wider framework within which to encourage investments in the technological development process, including research, development and adaptation. According to OECD, in OECD member countries, for example, funds to promote cleaner technologies are being used to offset the costs and risks associated with the development/ demonstration phase of new technologies. This phase is where costs and risk are more significant and chances for technical failure much higher. Funds are also being used to support the practical implementation phase. Similar support programmes can be implemented in developing countries, often through development assistance programmes or joint ventures in the private sector. 7/

15. Changing production processes to cleaner production requires a much deeper understanding of the entire production process and of the technological systems involved. The issue for many developing countries may be access not so much to a particular technology as to the process of technological change. Capacity for handling the "software" part of the technology package has become a key requirement for successfully managing technological change. A more sophisticated level of training and education is needed at the enterprise level to understand the links among technology performance, competitiveness and environmental benefits. This will enhance the ability to adapt, maintain and upgrade new technologies. This can be realized best in the collaboration between technology suppliers and potential users. Technology cooperation and partnerships must focus on the management of technological change.

16. The role of the private sector in the development, transfer and diffusion of ESTs, the increase in research and development activities undertaken by the private sector, and the rapid expansion in foreign investments have been well recognized. In this regard, the potential role of transnational corporations (TNCs) in the transfer of ESTs has been highlighted. 8/

17. OECD has stated that the business sector has been increasing expenditures for environment goods and services, not only to respect environmental regulation but also to capture economic benefits from reducing consumption of raw materials and energy and reducing waste and pollution. Economic benefits and economic instruments are becoming the most important driving force to achieve environmental goals. More enterprises are perceiving the environment as a

scarce and strategic resource, increasing the benefits from investing in environmental management. 9/

Box 2. Initiatives of major groups

The World Business Council for Sustainable Development has established, in partnership with the United Nations Development Programme (UNDP), Sustainable Project Management (SPM), an autonomous non-for-profit association designed to develop and structure "eco-efficient" business projects that will contribute to sustainable development. SPM intends to have learning and demonstration effects by cooperating with business leaders in developing countries and economies in transition on ways to improve the efficiency of production processes in both environmental and economic terms.

The International Federation of Agricultural Producers (IFAP) has organized a regular dialogue among national farmers' organizations, agricultural research systems and extension institutions in Africa and Asia. It constituted an important basis in the search for sustainable farming systems that promote the use of indigenous knowledge and material, along with judicious and environment-friendly conservation.

World Wide Fund for Nature (WWF): The United States of America and WWF-Netherlands are helping WWF-India in a pilot programme on technology transfer to promote the reduction in emissions of greenhouse gases and stratospheric ozone-depleting substances. WWF's partners in this project are the Confederation of Indian Industry, the Tata Energy Research Institute and the Society for Development Alternatives.

Greenpeace publishes on a regular basis its Inventory of Toxic Technologies, an ongoing compilation of information about hazardous technologies that it believes should be phased out globally rather than transferred.

The Norwegian Society of Chartered Engineers assumes the responsibility for managing transfer of knowledge in waste minimization/cleaner production strategies, funded by the Norwegian Government, in Poland, the Czech Republic and Slovakia.

18. Business and industry have also made considerable progress in articulating their position on environmental technology cooperation and partnerships, and their readiness to engage in such activities. There are many business organizations dedicated to aspects of environmental management or to the environmental technology needs of a particular industry sector. International business networks for environmental technology cooperation, such as the Industry Cooperative for Ozone Layer Protection (ICOLP), are particularly successful when focused on specific industries or technologies. 10/

19. Governments of developed and developing countries and economies in transition have several avenues for promoting transfer of ESTs, cooperation and

capacity-building. The Hanover Workshop refers to some that are pertinent to national policies and strategies:

(a) Developed country Governments that are explicitly promoting cleaner technologies need to interact more closely with the private sector in their own and recipient countries;

(b) More donor agencies (both bi- and multilateral) need to include ESTs as an integral part of their technology cooperation and technical assistance programmes;

(c) Developing countries and countries with economies in transition could develop national programmes for using ESTs to foster cleaner production and products. This could amount to a business plan for deploying ESTs where they would contribute most to preventing pollution and wastes;

(d) These countries ought to create the demand for ESTs. This calls for setting an appropriate framework of policy and legal measures, and economic incentives to encourage the private sector to invest in ESTs.

II. ACCESS TO AND DISSEMINATION OF INFORMATION ON ENVIRONMENTALLY SOUND TECHNOLOGIES

20. The ability to obtain information on available technological alternatives is the first step towards making greater use of ESTs and upgrading systems of production. The experiences of UNEP and others show that the future widespread adoption of ESTs in developing countries and economies in transition will largely be an exercise in improved information exchange and capacity-building.

21. The adoption of a regulatory framework is an important precondition for the development and use of ESTs. The Seoul Workshop recognized that the adoption of environmental regulations or standards ought to be accompanied by the provision of economic incentives and capacity-building. It was also recognized that regulatory frameworks should consider local environmental problems and conditions. 11/

A. Information networks

22. The importance of country-based information access points that should be networked with other facilities for technology transfer such as centres for training, demonstration and transfer of ESTs has been recognized. However, since a large number of information channels (for example, chambers of commerce, industry associations, research centres, databases, national and international information systems) already exist, there should be strengthening of these channels rather than a creation of new ones.

23. A multiplicity of access points to information about ESTs is needed, provided those points are coordinated and networked to ensure efficient and cost-effective operations. Participants in the Seoul Workshop saw the need for

a consultative mechanism dedicated to enhancing cooperation and consistency between existing and emerging information systems.

24. There is a distinction between the information-delivery sources connected to legally binding international agreements and those not related to such agreements. Information systems established under legally binding international agreements (the Montreal Protocol on Substances that Deplete the Ozone Layer and the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal) are integral parts of a well-structured support mechanism. This is in contrast to Agenda 21, 12/ in which no specific support structures have been established to facilitate technology transfer. The importance of this distinction is illustrated by the UNEP Industry and Environment (IE) Office experience in operating the OzonAction Information Clearing-house (OAIC) and its International Cleaner Production Information Clearing-house (ICPIC).

25. The Parties to the Montreal Protocol recognized that successful phase-out of ozone-depleting substances would largely depend on the effective transfer of technology from developed to developing countries. The OzonAction Programme to facilitate technology transfer covers most of the steps required for effective functioning of OAIC. First, there is a clear need for the technology transfer to comply with a legally binding international agreement (the Montreal Protocol and its Amendments). Second, awareness of this need and development of national strategies are handled through country programmes. Third, there is an extensive effort to obtain and distribute, on a wide scale, information on the available technical options and sources of technologies, equipment and chemicals. Fourth, there is extensive training and networking to build local capacities for phasing out ozone-depleting substances. Fifth, and most important, there is financial support through the interim Multilateral Fund for the Implementation of the Montreal Protocol for information collection and dissemination, the development and use of country programmes, and the technology implementation process. 13/

26. ICPIC is an element of UNEP IE's Cleaner Production Programme. While cleaner production has been mentioned throughout Agenda 21 and international interest in this subject has been increasing, a more concerted effort was needed to translate this general level of interest into action. However, technology transfer under the Cleaner Production Programme is more difficult than under the OzonAction Programme. This is because there is no legal framework creating the demand for technology transfer and no special financial mechanism to provide support for national programmes. Therefore, the Cleaner Production Programme has embarked on a strategy of information exchange to create awareness of the need for cleaner production and, thereby, increase the demand for cleaner technologies. The key to successful implementation of this strategy is the existence of an effective information dissemination system providing relevant, timely and updated information; and, with this need in mind, ICPIC was developed. 14/

B. Requirements for successful information exchange

27. Information systems should be set up close to the end-users so as to: (a) ensure that end-users have knowledge of the existence of a given information source; (b) facilitate access by end-users; and (c) ease two-way information flow, that is, from the information source to local users, with feedback and lateral information exchange.

28. Both the systems for delivery and the information content must be based on user needs and capabilities. Therefore, knowledge of user needs is as important as the ability of the information user to know why technology is needed, what technological options are available and how to assess and apply an appropriate technology.

29. The Seoul Workshop emphasized that the information being provided about ESTs must accurately reflect the real needs of the users, that is to say the information must be demand-driven, not supply-driven. Changing regulatory environments, new technological developments and shifting economic imperatives all contribute to the modification of user needs. To ensure that EST information systems sufficiently address those needs, regular feedback mechanisms should be established by the EST information providers to gauge user requirements.

30. On the demand side, specificity of information is important, including a clear indication about the range of EST options available, their costs, how and where to get them, and a record showing the experience of other users. On the supply side, experiences and information are necessary concerning market opportunities in developing countries. 15/ Brokering services to make both partners aware of these opportunities should be provided.

31. The participants in the Seoul Workshop felt that technology suppliers, including multinational corporations, should be encouraged to learn about local needs and conditions in developing countries, and to actively seek partners there for joint ventures, licences and subsidiaries. Technology users should be informed about opportunities to adopt new ESTs and to share local EST innovation with foreign companies on mutually beneficial terms. Joint technology development should receive more emphasis in the future.

C. Information needs of small- and medium-sized enterprises (SMEs)

32. Small- and medium-sized enterprises (SMEs) are often neglected in technology transfer activities owing to a variety of factors such as (a) the sheer number of SMEs involved; (b) their relative lack of capital, knowledge and technical capacities to acquire new technologies; (c) the lack of well-organized SME industry associations; and (d) the difficulties for technology suppliers to identify, understand and contact SMEs. 16/

33. In assessing the current situation of SMEs, a study commissioned by UNIDO's Industrial and Technological Information Bank (INTIB) concluded that information provided on advanced technologies is mostly targeted at the developed countries

and not at the developing ones. Even where information systems target users in developing countries, these are cases either of large corporations, which may have advanced communication capabilities to handle information effectively, or of consultants and researchers at universities or research institutes. 17/

34. The recent "Report on the Review under Paragraph 8 of Article 5 of the Montreal Protocol" (see document UNEP/OZ.L.Pro/WG.1/11/4, p. ES-7) says that most large and many medium-sized enterprises are able to obtain specific information from the implementing agencies or from the vendors of chemicals and technologies. The lack of information on alternate technologies available to small and informal enterprises, however, has impeded phase-out of ozone-depleting substances.

35. Poor telecommunications in many developing countries and limited availability of computers in SMEs are physical and psychological barriers to effective information and technology transfer. Few information systems function by means of local contact points or with methods appropriate to local needs. Even fewer systems have recognized the educational role they must play in creating the market they intend to serve.

36. SMEs in developing countries often do not appreciate the value of information about ESTs. For companies with limited resources, information is costly in terms of both time and money. However, database owners are often not aware of the value to SMEs in developing countries of the information they hold. Since owners of SMEs in these countries rarely place monetary value on information, they are unattractive targets for commercially run information systems. 18/

37. Some case-studies presented by participants at the Seoul Workshop demonstrated that financing institutions usually favour large-scale investments, while transfer of technology often requires tailor-made, small-scale solutions, and pre-feasibility studies, such as energy efficiency studies and environmental audits. In this regard, sector-specific technology intermediaries may be useful in providing necessary investments. To succeed, an intermediary should focus its mission on one sector or technical area, identifying and acquiring rights to relevant technologies, locating potential users, facilitating licensing or investment arrangements, and providing management, technical and other advice. 19/

38. Promotional measures for information access and dissemination should have a strong focus on overcoming the information shortfall of SMEs, since large companies usually have their own information sources. INTIB's environmental information strategy for the next few years will specifically address the needs of SMEs in developing countries, while continuing a broader programme of information collection and dissemination.

39. Measures to facilitate and promote information flow to SMEs should be addressed to (a) technology suppliers, concerning knowledge of developing countries' needs and potential market opportunities and (b) technology buyers/recipients in developing countries, about the availability and appropriateness of technological solutions and services. Moreover,

demonstrations of technology applications under specific field conditions including on performance and maintenance requirements would be important.

D. Recommendations

40. Concrete measures should be taken to promote the exchange of information about ESTs and the capabilities of information users, with focus on SMEs, taking account of the recommendations contained in the Seoul Plan of Action. In this regard, the Commission on Sustainable Development may wish to consider the following proposals:

(a) The United Nations system, secretariats of the various conventions and other international organizations should consider appropriate action towards designing a "consultative mechanism" to enhance cooperation and compatibility between existing and projected information systems, for example, those operated by - or with the support of - the United Nations system, international conventions, non-governmental organizations or the private sector. The aim would be to make all interested partners aware of existing and planned information systems and to effect, to the extent possible, compatibility and interconnection between them. A first step in designing this consultative mechanism could be the preparation of a survey of existing information systems and sources related to ESTs. Such a survey has been initiated by UNEP;

(b) Governments, international organizations and the private sector should undertake efforts to enhance the exchange of information on the successful implementation of EST transfer operations, for example, through international workshops, dissemination of well-documented case-studies and networking activities. Cases should relate to the various "stages" in improving environmental performance, for example:

(i) Performing of environmental audits;

(ii) Better management control of the actions of existing plants ("good housekeeping");

(iii) Replacement of old equipment with the available pollution prevention technologies;

(iv) Development and introduction of new clean processes;

(v) Economic/financial benefits to be realized by use of ESTs.

III. INSTITUTIONAL DEVELOPMENT AND CAPACITY-BUILDING FOR MANAGING TECHNOLOGICAL CHANGE

41. Capacity-building, as discussed in this report, relates to creating the institutional climate and developing the human capabilities required to successfully implement the technology transfer process as a whole. Measures to be applied aim at organizational and institutional improvements, upgrading of technical and mechanical skills and build-up of the capabilities to understand and assess the performance of technologies in specific contexts. Improving capabilities for innovation by technology users and managing the incorporation of technologies in productive processes are also included.

A. Institutional factors

42. Three sets of factors may contribute to creating the institutional environment required to make technology transfer successful:

(a) Enabling conditions for technology development which would include:

(i) Technology progress considered as a national priority;

(ii) Institutional reforms made to eliminate disincentives to technology development;

(iii) Indigenous technology initiatives encouraged through market-related incentives to simplify commercialization of local products and processes;

(b) Strengthening the "technology triangle" as an effective mechanism for enhancing capacity-building. The technology triangle consists of strategic interactions between:

(i) Institutions of science and technology that generate knowledge and skills;

(ii) Business and industry that commercialize and use new technologies;

(iii) Government that sets regulations for directing technology advances.

Strengthening the linkages between these points of the technology triangle and creating incentives for cooperation greatly enhance technology development by consolidating national capabilities and linking public-private initiatives to a nation's intellectual and scientific capital; 20/

(c) Mechanisms to enhance North-South and South-South technology collaboration including:

(i) Joint initiatives to produce scientific inventions and innovations in technology frontier areas;

(ii) Professional and electronic networking to strengthen access to international technology information systems.

B. Promoting environmentally sound technology centres

43. Institution-building was recognized in inter-sessional meetings as an important element of the "enabling" environment to be created at the national level so as to promote the development, transfer and diffusion of ESTs. The participants in the Seoul Workshop emphasized the important role that environmentally sound technology centres (ESTCs), or their equivalent networks, could play in the promotion of ESTs. 21/ The discussion at the Vienna Round Table on institutional initiatives focused primarily on such concepts as cleaner production centres and ESTCs. 22/ The second session of the Open-Ended Ad Hoc Committee for the Implementation of the Basel Convention agreed to establish subregional centres for training and technology transfer on the environmentally sound management of hazardous wastes and the minimization of their generation in the Latin American and Caribbean regions (UNEP/BC/94/1).

44. The Seoul Workshop specified some operational terms and the functions that should be performed by the ESTCs or their equivalent networks: the promotion of ESTCs should build upon existing national institutions/organizations in countries, including research centres - centres, for example, established with the support of UNEP/UNIDO or of bilateral donors. The private sector must be directly involved in or connected with the ESTCs. The ESTCs should communicate with one another, and could also act as brokers to facilitate business operations. They should perform the following functions:

(a) Building awareness;

(b) Providing regular assessments of user needs;

(c) Training;

(d) Providing access to information from many sources;

(e) Initiating demonstration projects;

(f) Helping to identify financial resources;

(g) Helping to identify and obtain transfer of public domain ESTs. 23/

45. The Vienna Round Table built upon the conclusions of the Seoul Workshop. It was stressed that neither the term "cleaner production centre" nor the term "ESTC" signified a particular institutional structure; instead these could denote networks, national programmes or functions undertaken by different institutions. The key point made was that cleaner production efforts ought to be tailor-made, within the specificity of national institutional capabilities, industrial structures and environmental goals. Despite the need to have differentiated approaches, there were certain common ingredients that could be identified for cleaner production efforts. Building upon the functions identified by the Seoul Workshop, it was felt that, on a priority basis,

attention might be given to (a) training of trainers and advisers; (b) demonstration projects that highlighted the economic and environmental benefits of the use of ESTs and management skills; (c) awareness-building, inter alia, through dissemination of well-documented case-studies that clearly presented those economic benefits; and (d) capacity-building for technology assessment.

46. Regional cooperation was considered significant in the drive for cleaner production in terms of the following several elements: (a) the need to network centres so as to address transboundary environmental issues; (b) the need to develop training programmes; and (c) the need to effect sharing of experiences reflecting common problems. The networking of some centres within, and between, regions could enable the sharing of experiences among countries in the development and transfer of environmentally sound technologies.

47. Multilateral and bilateral efforts to support institutional networking would benefit from improved coordination. Such coordination could take several forms. For example, existing efforts in the field of industry could be linked with national or regional endeavours to implement international conventions such as the United Nations Convention to Combat Desertification in those Countries Experiencing Serious Drought and/or Desertification, particularly in Africa (A/49/84/Add.2, annex, appendix II), and the Convention on the Ban of the Import into Africa and the Control of Transboundary Movements of Hazardous Wastes within Africa. Also, the efforts in one sector could benefit from the involvement of other United Nations organizations in order to develop intersectoral linkages. A specific example could lay within the possibilities for augmenting the UNIDO/UNEP national Cleaner Production Centres by associating capacity-building efforts by UNDP and the United Nations Educational, Scientific and Cultural Organization (UNESCO). The networking of some centres within, and between, regions could enable the addressing of transboundary environmental issues and the sharing of experiences of countries in the development and transfer of ESTs.

48. The Commission on Sustainable Development can play an important role in the coordination of bilateral and multilateral efforts to support institutional networking at the country level, with the objective of better enabling the utilization of expertise available in countries and international organizations or of developing approaches that have already been undertaken. Concrete proposals need to be worked out, also involving the secretariats of the various conventions. 24/ The proposals should be based on existing initiatives, such as the UNIDO/UNEP Cleaner Production Centres, which were designed to perform those functions identified in the Seoul Workshop and specified at the Vienna Round Table. ESTCs could provide an opportunity for coordinated donor support.

C. Training of human resources

49. Lack of skilled human resources on the side of the technology user, particularly in developing countries, has been recognized as producing a bottleneck in technology transfer. The lack of skilled staff grows acute as the process of technology generation, transfer and diffusion becomes increasingly complex.

50. Addressing this issue, an OECD publication noted that the skills required to use a particular technology effectively did not necessarily lead to the mastery of the skills required to change or adapt it. These capacities must be acquired through a conscious effort of "technological learning", and the investment of substantial resources. The buyer of technology must deliberately obtain the capabilities necessary to operate, maintain and adapt the technology. These capabilities were cumulative, not easily bought in the international markets and took considerable time to develop. The sellers of technology would increasingly need to offer long-term training packages to remain competitive. 25/

51. The 1994 UNEP IE Office Consultative Meeting with Industry/Trade Associations raised concern over the lack of environmental management capacities, in particular in SMEs. It concluded that for companies to operationalize sustainable development, training in environmental management was an indispensable requirement. Emphasis should be placed on supporting managers of companies, particularly of SMEs in developing countries, in building the necessary capabilities to put appropriate environmental management systems into practice. 26/ ESTCs could help in performing this task.

52. Existing educational and scientific structures are based largely on disciplinary or sectoral approaches. While training aimed at achieving excellence and skills in specific disciplines will continue to be a critical component of capacity-building, the kind of training that is disciplinary and sectoral must in the future be complemented by training that is of an increased and improved interdisciplinary and intersectoral type. Similarly, the development of institutions and their functioning should address the challenge of interdisciplinarity and the need to establish cross-sectoral linkages. UNESCO advocates an integrated approach that links (a) training of scientific and technical staff; (b) development of the appropriate institutions including high-quality learning institutions; and (c) promotion of a "scientific culture".

53. The Regional Centre for Graduate Study and Research in Agriculture (SEARCA) considers human resources training an important requirement equipping project managers and engineering staff with the skills needed for effective technology evaluation. It is also evident that training seminars and field demonstrations are important avenues of elucidation and persuasion concerning the benefits and risks, to technology end-users, involved in the application of certain technologies. 27/

D. Environmentally sound technology assessment

54. New technologies pose both opportunities and risks for the environment that need to be assessed before significant financial and social commitments are made. Environmental risk assessment is becoming an important element in the investment approval process of international development banks and other financial institutions. For example, International Finance Corporation engineers and environmental specialists support the transfer of ESTs as part of the project appraisal process. Every proposed investment is reviewed to ensure that the technology is environmentally sound. Technical assistance may be provided to the client in addressing any deficiency in project design.

55. Senior managers and account officers of banks, venture capital funds and leasing companies are encouraged to include evaluation of environmental performance as part of their normal credit review. As financial institutions pay increasing attention in investment or credit decisions to environmental performance of their clients, those clients will be motivated to use technologies that are environmentally sound. 28/

56. It is essential to build the user's capacities and capability to carry out assessments on how technologies to be introduced or transferred will act under specific conditions. Those assessments need to be sector- or project-specific. However, the development of basic criteria or general guidelines for the evaluation of environmental and safety performance could be important tools in transferring and applying ESTs. 29/ In the context of assessing technology options, the Vienna Round Table referred to environmental performance indicators (EPIs) that could be developed by Governments in consultation with industry and others concerned in order to establish commonly stressed targets and goals. 30/

57. Recognizing the importance of basic guidelines for the successful implementation of technology transfer, the Seoul Plan of Action proposed to develop and agree upon basic criteria and guidelines for evaluation of environmental and safety performance building upon already existing work. These guidelines should emphasize transfer of cleaner technologies. They might help the concerned parties in ensuring that the technologies were appropriate to the goals of sustainable development. The criteria and guidelines should also be used for private sector transfer. 31/

58. The feasibility study being carried out by UNEP IE's Environmental Technology Assessment (EnTA) Programme could provide a possible starting-point for developing such basic criteria or general guidelines. The Third High-Level Advisory Seminar on Cleaner Production recommended that UNEP should continue its initiatives to develop technology assessment methodologies and criteria for environmental technology assessment. 32/ The "Technical Guidelines for the Environmentally Sound Management of Wastes Subject to the Basel Convention" being prepared by the secretariat of the Basel Convention could also help (UNEP/94/3-SBC/94/5).

59. The general guidelines set forth the details of a process for clarifying the environmental implications of different technology choices. They are structured in such a way as to consider each party involved in technology transfer, outlining its responsibilities and indicating approaches to meeting them. They could take the form of a series of basic environmental questions to be asked about technologies, and approaches to answering the questions, and to identifying the information needed. This could be supplemented with basic references, and the listing of institutions involved in technology assessment, and of information sources. 33/

E. National needs assessment in support of environmentally sound technology transfer and capacity-building

60. The Commission on Sustainable Development, at its second session in 1994, recognized that assessment of needs for capacity-building and institutional development related to ESTs could be useful in enhancing development, deployment and transfer of those technologies. It was proposed that to benefit from the experiences gained from those exercises, the Commission should encourage developed and developing countries to jointly conduct case-studies on needs assessment at the national level (see document E/CN.17/1994/11, para. 36 (a)).

61. The European Commission intends to finance a joint European Commission/ Tunisia case-study on environmentally sound technology, applying the methodology adopted by the Commission on Sustainable Development's Inter-sessional Ad Hoc Open-Ended Working Group on Technology Transfer and Cooperation (see document E/CN.17/1994/11). The objective of the initiative is to help Tunisia in the development of the institutional and human capacities required to introduce environmentally sound technologies. Particular attention will be given to strengthening national capacities in (a) identification and evolution of Tunisia's technological needs; (b) acquisition of information on existing technologies; (c) selection and application of suitable technologies; and (d) appropriateness of transfer of technology on favourable terms. The study will also examine the possible role that the Eco-Technology Centre announced by the Tunisian authorities could play.

62. In Costa Rica, a national needs assessment study on ESTs is being supported by the Netherlands. The study covers the needs for national capacity-building in a broader sense (for example, in-the-field education, research, intermediary infrastructure, specific knowledge, enforcement of environmental regulations, cooperation between actors). The aim of the study is to supply Costa Rica with an effective tool for donor management. The Netherlands' support consists of the supply of financial means and expertise.

63. Switzerland and Pakistan will collaborate in a project that will identify the demand of Pakistan for EST in two industrial subsectors (possibly textiles and paper), and make concrete recommendations concerning (a) enhancing the capabilities to absorb environmentally sound technologies that are suitable to the conditions and the socio-economic and environmental requirements of the subsectors concerned; (b) involving local techniques, technologies and resources; and (c) promoting technology transfer, through partnerships between technology suppliers from Switzerland and potential users in Pakistan.

64. More experience is required on needs assessments for ESTs. There is also a need for exchanging the experience gained in current cooperation projects, in order to compare approaches and identify their respective strengths and weaknesses. Governments should provide the Commission on Sustainable Development with the appropriate information to enable the Commission to keep this issue under review.

F. Research and development

65. The existence of national research and development capacities in developing countries is critical to successful technology transfer and to the participation of these countries in international research and development cooperation. According to a report of the European Community, new growth theory suggests that technological progress and economic development are a function of accumulated investment in research and development and human capital, and that importing technology is not an alternative to indigenous research and development. In fact, the (European) Community has found that internal research and development is essential for efficient technology transfer. 34/

66. European Union evaluations of scientific and technological cooperation programmes with developing countries and countries in transition have highlighted their scientific quality and cost-effectiveness. The Union has learned a number of lessons from these programmes. These lessons, to be incorporated into the Union's future policies for cooperating with developing countries and countries in transition in research and technological development, involve the following: (a) the importance of mutuality in project planning and the implementation phase; (b) the need to base scientific cooperation on the priority needs identified in developing countries and countries in transition; also, the fact that without local/national support, investments in human capital, and scientific infrastructure are not sustainable; (c) the need to consider research priorities in relation to other policy areas such as development cooperation; (d) the fact that greater input from local scientists in developing countries and countries in transition is necessary from project formulation through to management, and an increase in the number of joint publications; and (e) the fact that the economic and environmental problems of sustainable development required an interdisciplinary approach. Building on local knowledge is vital to making research and its results relevant. 35/

G. Recommendations

67. Measures should be applied to improve the organizational and institutional environment, to upgrade technical and mechanical skills, to build up the capabilities to understand and assess the performance of technologies in specific contexts, and enhance innovation capabilities on the side of the technology user, and to manage the incorporation of technologies into productive processes. In this regard, the Commission on Sustainable Development may wish to consider the following proposals:

(a) Governments, the United Nations system, secretariats of the various conventions, other international organizations and the private sector should join in their efforts to enable countries to undertake the functions of ESTCs, or their equivalent networks, as identified in the Seoul Plan of Action, giving priority attention to:

(i) Training of trainers and advisers;

(ii) Demonstration projects that highlight the economic and environmental benefits of the use of ESTs and management skills;

(iii) Awareness-building, inter alia, through dissemination of well-documented case-studies that clearly present those economic benefits;

(iv) Capacity-building for technology assessment;

(b) The United Nations system, secretariats of the various conventions and other international organizations should join in their efforts to develop basic criteria and guidelines for environmentally sound technology assessment, building upon already existing work. These guidelines could emphasize transfer of cleaner technologies;

(c) Governments are invited to share experiences gained in conducting national needs assessments in support of EST transfer and capacity-building, and to make the results available to the Commission. There is also a need for exchanging experiences gained in current cooperation projects, in order to compare approaches and identify their respective strengths and weaknesses;

(d) Governments are encouraged to develop, in consultation with industry and others concerned, environmental performance indicators (EPIs) in order to establish commonly stressed targets and goals in the context of assessing technology options.

IV. FINANCIAL AND PARTNERSHIP ARRANGEMENTS

68. The rapid growth in demand for ESTs, particularly in developing, Eastern European and newly industrializing countries, opens up new opportunities for EST cooperation and partnerships. Expansion of the global operation of major firms, as they set up foreign operations to enter markets, and seek foreign partners to develop new technologies, may also advance the scope for EST cooperation and partnership arrangements. 36/

69. The need for enhanced North-South and South-South cooperation was recognized in the various inter-sessional meetings based on the fact that developing countries within a region, for example, face similar environmental concerns and are at equivalent levels of development. Two important mechanisms for these links are (a) joint research for problem-solving to assure that capacity-building measures are targeted at the frontiers of technology ("new" ideas and technologies) and to facilitate "leap-frogging", and (b) professional and electronic networking to strengthen access to international technology information systems.

70. With regard to South-South cooperation, it was stressed that it could potentially reduce costs of developing ESTs, thereby improving their viability. South-South cooperation could be, inter alia, enhanced via regional or subregional networking or by creating regional centres for research, training and technology transfer. This could, for example, enable a group of countries to link themselves to international research and development efforts. Constraints could be faced owing to the limited resources available to finance such cooperation. In order to mitigate these constraints, international organizations should support South-South cooperative efforts, particularly

through networking institutions in developing countries, as well as between institutions in developed countries and those in developing countries.

71. Initiatives should also be taken to integrate countries undergoing the process of transition into the system of global cooperation and partnerships in the areas of research and development, and transfer of ESTs. 37/

A. International capital flows 38/

72. In many developing countries and countries with economies in transition, the availability of private international capital has increased dramatically in recent years and is now substantial. Private sector flows have been targeted at the more industrialized developing countries, and thus correspond closely to those areas where the need for ESTs is greatest. In many of those countries, private sector flows now dominate official flows, particularly in terms of flows to the industrial sector. Furthermore, official flows are unlikely to grow rapidly, and have many other demands upon them (for example, poverty alleviation).

73. Direct public sector involvement in financing EST transfer is probably less effective than a policy and regulatory regime that clearly encourages or compels private companies to buy, sell and/or develop ESTs. This is owing to the fact that while directly intervening in the market-place may help to channel millions of dollars, or their equivalent, in favour of EST transfer, changing the very conditions under which business investment decisions are made has the potential to channel billions.

74. Over the period 1990-2020, developing countries are expected to increase their output from $9 trillion to $34 trillion - a nearly fourfold increase averaging about 4.5 per cent per year. For this increase of $25 trillion in output to occur, large amounts of capital will be needed. For example, Asian countries (other than Japan) plan to spend about $1 trillion on transport, communications, power generation and other infrastructure over the next 10 years. While most of the capital will come from domestic savings, McKinsey, the global consulting firm, estimates that the developing countries as a whole will need to import $2 trillion over the coming decade.

1. Foreign direct investment

75. According to the World Industry Council for the Environment (WICE), 39/ inbound foreign capital only accounts for some 3-4 per cent of total domestic capital formation in developing countries, the vast majority coming from domestic savings. Though small in financial terms, foreign capital plays a much larger role in terms of transferring skills, new technologies, new ideas and new management techniques.

76. Much foreign direct investment (FDI) is not directly oriented towards transferring ESTs to developing countries. In fact, some experts worry that FDI serves to transfer fewer environmentally sound technologies to developing countries as companies in more heavily regulated developed countries seek either

to sell off outmoded capital equipment and/or to shift production to jurisdictions with lower environmental standards. In recent years, however, these fears have become less justifiable for several reasons. First, many developing countries are raising their environmental standards and therefore are less willing to be a dumping ground for older, more polluting technologies. Second, larger foreign investors can no longer afford the risk of bad publicity that comes from poor environmental performance at any of their operations. Third, technological innovations are making ESTs more economically attractive and hence there are few, or fewer, advantages to be gained from using older, typically more polluting technologies.

2. Overseas portfolio investment

77. The World Institute for Development Economics Research expects that annual new portfolio investment in the developing countries will grow to $100 billion per annum by the end of this decade. Capitalization of emerging stock markets has leaped 10-fold since 1985 to $2.2 trillion in 1993 compared with $11 trillion for the industrialized economies. Even international bank lending is beginning to recover from the debt crisis of the 1980s.

78. There has been little research on the role of overseas portfolio investment in transferring ESTs to developing countries. Logically, the impacts either way are likely to be less clearly linked than they would be for foreign direct investment. A large amount of capital has been raised by developing country enterprises on the global capital markets to finance modernization and efficiency improvements that typically involve capital expenditure on ESTs. This is particularly so of privatized enterprises, including formerly State-owned utilities.

79. While overseas portfolio investment finances the modernization of former State-owned enterprises, much of it also flows into large privately-owned companies operating in natural resource sectors. There is considerable concern among environmental non-governmental organizations that portfolio flows into these companies are doing harm because they facilitate the rapid exploitation of natural resources without any environmental safeguards.

3. Privatization

80. Privatization of public enterprises is a major feature of the economic restructuring of the developing countries and transitional economies. The development banks, lead by the World Bank, are supporting privatization through policy and project lending and also technical assistance. Many privatization candidates leave behind significant environmental risks or "pollution stocks". Furthermore, many candidates may be the source of continuing "pollution flow" problems or could be drawing down stocks of natural resources at an alarming rate. Privatization may therefore recapitalize and revive polluting firms that would otherwise go out of business.

81. Privatization can also produce positive environmental effects, such as increased efficiency in the use of natural resources and more rapid adoption of

ESTs. At present, the World Bank advises many Governments to assume responsibility for most or all damages or hazards resulting from past practices, thus providing the new owner with a "clean slate". On the other hand, many private investors insist on special concessions such as reductions in price and indemnification, while others are willing to undertake cleanup if reimbursed from purchase funds.

82. There is considerable scope for incorporating EST criteria into the structuring, negotiating and financing of privatization programmes and tenders. Rather than awarding tenders to the highest purchaser or to the bid that offers the lowest cost of service provision, Governments could weight decisions with EST investments and environmental improvements in mind. This might also help to overcome political obstacles where foreign ownership is an issue. Turning this idea into practice will generally require significant technical assistance from donors. Leverage over policy makers might be enhanced or backed up by lending operations.

B. Public-private partnerships

83. Often an effective way to accelerate the financing of EST transfer is by public-private partnership. The public sector involvement, including that of international aid agencies and development banks, in such partnerships can be justified based on four main reasons:

(a) There is often a need to mitigate political and commercial risks, be they perceived or actual, so as to unlock private capital and technology flows;

(b) There is often a need to show that EST technologies deliver real, cost-effective benefits to the end-user before these technologies can be widely diffused using market mechanisms;

(c) There may be a need for financial innovation for EST transfer that, at least initially, requires public sector leadership;

(d) Some ESTs might not be competitive with alternatives from a business standpoint but their transfer should be subsidized for public interest reasons.

84. Where Governments, or the international organizations they finance, join with the private sector to transfer ESTs, it is typically with the hope or expectation that the private sector will be willing and able to undertake the transfer process without public sector involvement in the longer run. In the shorter term, the aim of public-private partnerships is to lever public resources to mobilize private capital and harness market forces as much as possible.

85. The higher the perceived, if not actual, risks of investing in developing countries, the shorter the time-horizons of investors and lenders and the higher their expected rates of return. As a result, many EST investments can seem unattractive to private investors. Public-private sector partnerships can therefore be created that reduce risks in order to lengthen maturities and reduce the price of capital.

86. Evidently, there is a small but growing number of public-private financial mechanisms supported by aid agencies that are aimed at the development and diffusion of ESTs. These initiatives are encouraging because they represent more than additional capital: they represent innovative models in themselves. They also represent an opportunity to show that EST investments increase the competitiveness of companies that invest. Nevertheless, the funds currently being mobilized for EST investments in the developing countries come nowhere near meeting the potential demand for such investments.

87. Several types of innovative partnerships have been identified in the various inter-sessional meetings and the material provided by Governments, international organizations and the private sector.

1. Technological and financial intermediaries

88. One important category of partnership is the publicly funded intermediary for EST transfer. It aims to help in the development of projects oriented towards transferring ESTs, through providing pre-investment support, such as funding of feasibility studies, finding of partners and preparing of bankable proposals, thus enabling the mobilization of private capital.

89. In examining two models of technological intermediaries being developed in the Asian context, the Vienna Round Table concluded that more analysis would be needed of cases of successful technology intermediaries, and that case-studies needed to be provided to the international community at large, in order to facilitate the emulation of such initiatives. Furthermore, given the chain of events required to implement technological change, the role of these intermediaries is considered vital to the adoption of ESTs, especially to SMEs.

90. As regards financial intermediation, there was a general recognition that the lending practices of the private sector and of development finance institutions did not readily support the required investment in cleaner production and ESTs. In many cases, such investments are incremental in nature and of a relatively small amount. Capacity-building efforts are needed to enable entrepreneurs to prepare bankable projects. In addition, investigations could be made, at the national level, to ascertain whether lending practices could be made more flexible so as to be able to entertain the possibility of a demand for financing the investment needs identified through cleaner production programmes. 40/

2. Build-Operate-Transfer (BOT) arrangements 41/

91. Build-Operate-Transfer (BOT) arrangements have been used by several countries as an alternative to foreign borrowing or investment from the public budget for the development of infrastructure. The importance of BOT arrangements to sustainable development arises from its potential for infrastructure investments in such areas as power and water-supply systems. In 1993, estimates show that globally, some 400 BOT projects were under consideration in the power, transportation and water sectors, at an aggregate

value of about US$ 430 billion. In negotiating BOT arrangements, it would be important to ensure that environmental objectives are fully incorporated.

Advantages of BOT arrangements:

(a) Use of private sector financing to provide new sources of capital, which reduces public borrowing and direct spending, and which may improve the host Government's credit rating;

(b) Ability to accelerate development of projects that would otherwise have to await, and compete for, limited external resources;

(c) Use of private sector capital, initiative and know-how to reduce project construction cost and schedules and to improve operating efficiency;

(d) Allocation of such project risk and burden to the private sector as would otherwise have to be undertaken by the public sector;

(e) Sponsors' incentives and risks as well as involvement of experienced commercial lenders providing in-depth review and additional assurance of project feasibility;

(f) Technology transfer and local capability-building, encouragement in the development of national capital markets and other substantial derivative benefits realizable from BOT projects;

(g) Possibility for Governments to build environmental impact and environmental performance parameters into the design and operation of the projects.

Drawbacks of BOT arrangements:

(a) The application of the BOT concept is a complicated undertaking compared with conventional financing of public sector projects and has been fraught with many difficulties. Although many BOT projects have been proposed and advertised, relatively few projects have actually been implemented;

(b) The outcome of BOT negotiations is often in doubt, partly because criteria and standard solutions on important issues have been slow to develop. Project studies and proposals that are not properly prepared have resulted in increased costs, delays and frustrations. Divergent positions on costs of construction, equipment and financing have caused difficulties and protracted negotiations. The need to work out pragmatic risk reward and security structures has not always been properly managed so as to attract investors. Lack of authority or lack of legislation has delayed negotiations for so long that projects have been abandoned. The legislation and regulations needed to streamline the implementation of BOT projects do not exist in most countries;

(c) BOT projects are complex from both a financial and a legal point of view. They require time to develop and negotiate. They require committed host Government involvement and support. Fortunately, with the benefit of the experience of the last decade, the basic structure needed to make a BOT project

viable is now better understood. Standard solutions are being worked out, so that many of the problems that seemed to be insurmountable are now being resolved. While any particular government agency may be low on the BOT learning-curve, the learning does exist and is available through private advisers and international organizations;

(d) A BOT project is very much a public-private partnership. It is first necessary for the Government to establish a rational process for the identification of suitable projects and the selection of bidders. The bidding procedures for BOT projects require some modification from conventional procedures. To fit the need for optimal technology transfer, flexibility in procurement and transparency in the entire process of developing and implementing the project are required. The availability of necessary government approvals, direction and support is critical to successful BOT projects.

3. The "technology triangle" concept

92. The "technology triangle" concept defines a public-private partnership that functions on the basis of strategic interaction and collaboration among government agencies and institutions, the private sector and institutions of science and technology. The objective is to stimulate the development, transfer and diffusion of ESTs through collaborative partnerships and capacity-building.

93. An example of successful action for strengthening the concept of the technology triangle as an internal partnership is evident from the status of environmental technology in the Netherlands. That success is due to the cooperation among the Government, industry, technological institutes and universities. One way in which the Netherlands Government is stimulating the development and application of environmental technology is through a special action programme, which devotes considerable attention to research on environmental technology. An example of this is the Innovative Research Programme for Environmental Technology (IOP). This programme is aimed at strengthening research on environmental technology at universities and technology institutes that study environmental biotechnology, recycling or waste prevention.

94. An example of an external technology partnership leading to the consolidation of a technology triangle internationally is the "Private-Public Partnerships for Urban Environments", an initiative of three institutions: the United Nations Development Programme (UNDP) (public sector), the Sustainable Project Management of the World Business Council for Sustainable Development (private sector), and the Technology and Development Program of the Massachusetts Institute of Technology (science and technology). This collaboration is supported by action at two levels: "horizontal" or international collaboration between three key sets of actors; and "vertical" linkages between each of these three actors and their respective constituencies within countries throughout the developing world. 42/

4. Environmentally sound technology venture capital funds

95. Another example of public-private partnerships is publicly sponsored investment funds with a focus on ESTs. Venture capital funds are particularly significant here. While the total amount involved so far is small, the potential leverage of these funds, and their effectiveness in transferring ESTs, are large.

5. Environmentally sound technology "guarantees"

96. To accelerate technological change and to encourage technology leap-frogging, the development of "technology guarantees" should be considered. Through such guarantees, a financially strong third party guarantees the performance of new ESTs. The rationale for such guarantees is that even after successful demonstration of technology, and full technology assessment, private capital markets can still require more time before they regard a technology as proved. This can impose a delay on the uptake of new technology, especially those with a long life.

6. Leasing arrangements

97. Leasing has many advantages, especially for SMEs: it is packaged, off-balance sheet and readily available. There is substantial scope for developing leasing facilities in the area of ESTs. The key attribute of leasing is that initial arrangements are made with the seller of the technology, whereby he or she agrees to support sales of his or her technology (rather than finance the purchaser). Ultimately leasing should evolve to become a private sector function. Initially it may need encouragement through public/private partnerships.

C. Recommendations

98. Successful technology transfer and management of technological change can best be realized in collaboration between technology suppliers and potential users. The Commission may wish to consider the following proposals:

(a) Financial markets should be encouraged to support ESTs. Particular measures would include:

(i) In banking, moving beyond liability-based Environmental Impact Assessments to broader assessments encompassing the potential for EST;

(ii) In capital markets, making information available on environmental performance (for example, resource use, waste produced), through stock market listings and annual reports, so as to make the cost advantages of ESTs transparent;

(iii) In fund management (including pensions management), making fund managers aware of the strategic investment advantages from ESTs;

(iv) In privatization, encouraging the use of EST criteria in tendering programmes.

The development banks, through their support of financial sector reforms, are probably best positioned to encourage these changes. In some cases, they would need to start by altering their own investment practices;

(b) Governments should be invited to take measures towards increasing the amount of external investment through, for example:

(i) Internalization of environmental costs within competitive markets;

(ii) Examination of the framework of laws and incentives that affect technology cooperation;

(iii) Compensation, in some cases, for risks perceived by foreign investors, for example, by way of guarantee schemes or soft loan contributions provided by Governments;

(c) Governments should take initiatives to enhance South-South cooperation, for example, through support for:

(i) Joint research for problem-solving to assure that capacity-building measures are targeted at the frontiers of technologies and to facilitate leap-frogging;

(ii) Networking among research institutes in developing countries;

(iii) Regional centres that play a role in information exchange and training for capacity-building;

(iv) Networking with international organizations;

(d) Governments, international organizations and the private sector should support the preparation and dissemination of case-studies on experiences gained in using intermediaries in the transfer and application of ESTs, in order to facilitate the replication of successful examples;

(e) Pilot projects should be conducted on the practicability of BOTs for promoting EST transfer, including building the capacities of developing countries and economies in transition to negotiate BOT contracts;

(f) Governments should be encouraged to strengthen the technology triangle at the national level, and to develop and utilize a similar approach at the international level.

V. ELEMENTS OF A WORK PROGRAMME FOR THE PROMOTION OF ENVIRONMENTALLY SOUND TECHNOLOGY TRANSFER, COOPERATION AND CAPACITY-BUILDING

99. The elements contained in this work programme are drawn from the recommendations listed at the end of each of the preceding sections of the report. These recommendations resulted from the various inter-sessional meetings referred to in the introduction to the report and throughout the text.

100. These inter-sessional meetings emphasized the coordinating role of the Commission on Sustainable Development within the United Nations system for activities related to the promotion of EST transfer, cooperation and capacity-building. They also affirmed the need for the Commission to move forward in the development and implementation of a programme of work on EST transfer, cooperation and capacity-building, with the objective of having it fully operational by 1997.

101. The Elements of a work programme, as presented in this report, are meant to be a point for departure of the discussion of the Commission on such a work programme.

A. National policies to promote the transfer of environmentally sound technologies (ESTs), cooperation and capacity-building

102. Policies and strategies need to be developed and implemented by national Governments to promote the development, transfer and diffusion of ESTs, including for the accelerated implementation of cleaner production programmes. Accordingly:

(a) Governments of developed countries are encouraged to include ESTs as an integral part of their technology cooperation and technical assistance programmes;

(b) Governments of developing countries and economies in transition are encouraged to develop sector-specific policies and programmes for using ESTs, in particular to promote cleaner production and products;

(c) Governments, in cooperation with international organizations, should enhance the exchange of experiences gained on the impact and effectiveness of economic instruments on the development, transfer and use of ESTs, through, for instance, international workshops and the dissemination of well-documented case-studies. The analysis of economic instruments should be on a sector-specific basis.

B. Access to and dissemination of information on environmentally sound technologies

103. Concrete measures should be taken to promote the exchange of information about ESTs and the capabilities of information users, with focus on SMEs, taking account of the recommendations contained in the Seoul Plan of Action. In this regard, the Commission may wish to consider the following proposals:

(a) The United Nations system, secretariats of the various conventions, and other international organizations should consider appropriate action towards designing a "consultative mechanism" to enhance cooperation and compatibility between existing and projected information systems, for example, those operated by - or with the support of - the United Nations system, international conventions, non-governmental organizations or the private sector. The aim would be that all interested partners should be aware of existing and planned information systems and that there should be, to the extent possible, compatibility and interconnection among them. A first step in designing this consultative mechanism could be the preparation of a survey of existing information systems and sources related to ESTs. Such a survey has been initiated by UNEP;

(b) Governments, international organizations and the private sector should undertake efforts to enhance the exchange of information on the successful implementation of EST transfer operations, for example, through international workshops, dissemination of well-documented case-studies, and networking activities. Cases should relate to the various "stages" in improving environmental performance, for example:

(i) Performing of environmental audits;

(ii) Better management control of actions of existing plants ("good housekeeping");

(iii) Replacement of old equipment with the available pollution prevention technologies;

(iv) Development and introduction of new clean processes;

(v) Realization by use of ESTs, of economic/financial benefits.

C. Institutional development and capacity-building for managing technological change

104. Measures should be applied to improve the organizational and institutional environment, upgrade technical and mechanical skills, build up the capabilities to understand and assess the performance of technologies in specific contexts, and enhance innovation capabilities on the side of the technology user, and to manage the incorporation of technologies within productive processes. In this regard, the Commission may wish to consider the following proposals:

(a) Governments, the United Nations system, secretariats of the various conventions, other international organizations and the private sector should join in their efforts to enable countries to take upon themselves the functions of ESTCs, or their equivalent networks, as identified in the Seoul Plan of Action, giving priority attention to:

(i) Training of trainers and advisers;

(ii) Demonstration projects that highlight the economic and environmental benefits of the use of ESTs and management skills;

(iii) Awareness-building, inter alia, through dissemination of well-documented case-studies that clearly present those economic benefits;

(iv) Capacity-building for technology assessment;

(b) The United Nations system, secretariats of the various conventions and other international organizations should join in their efforts to develop basic criteria and guidelines for environmentally sound technology assessment, building upon already existing work. These guidelines could emphasize transfer of cleaner technologies;

(c) Governments should be invited to share experiences gained in conducting national needs assessments in support of EST transfer and capacity-building, and to make the results available to the Commission. There is also a need for exchanging experiences gained in current cooperation projects, in order to compare approaches and identify their respective strengths and weaknesses;

(d) Governments should be encouraged to develop, in consultation with industry and others concerned, environmental performance indicators (EPIs) in order to establish commonly stressed targets and goals within the context of assessing technology options.

D. Financial and partnership arrangements

105. Successful technology transfer and management of technological change can best be realized through collaboration between technology suppliers and potential users. The Commission may wish to consider the following proposals:

(a) Financial markets should be encouraged to support ESTs. Particular measures would include:

(i) In banking, moving beyond liability-based Environmental Impact Assessments to broader assessments encompassing the potential for EST;

(ii) In capital markets, making information available on environmental performance (for example, resource use, waste produced), through stock market listings and annual reports, so as to make the cost advantages of ESTs transparent;

(iii) In fund management (including pensions management), making fund managers aware of the strategic investment advantages from ESTs;

(iv) In privatization, encouraging the use of EST criteria in tendering programmes.

The development banks, through their support of financial sector reforms, are probably best positioned to encourage these changes. In some cases, they would need to start by altering their own investment practices;

(b) Governments should be invited to take measures towards increasing the amount of external investment through, for example:

(i) Internalization of environmental costs within competitive markets;

(ii) Examination of the framework of laws and incentives that affect technology cooperation;

(iii) Compensation, in some cases, for risks perceived by foreign investors, for example, by way of guarantee schemes or soft loan contributions provided by Governments;

(c) Governments should take initiatives to enhance South-South cooperation, for example, through support for:

(i) Joint research for problem-solving to assure that capacity-building measures are targeted at the frontiers of technologies and to facilitate leap-frogging;

(ii) Networking among research institutes in developing countries;

(iii) Regional centres that play a role in information exchange and training for capacity-building;

(iv) Networking with international organizations;

(d) Governments, international organizations and the private sector should support the preparation and dissemination of case-studies on experiences gained in using intermediaries in the transfer and application of ESTs, in order to facilitate the replication of successful examples;

(e) Pilot projects should be conducted on the practicability of BOTs for promoting EST transfer, including building the capacities of developing countries and economies in transition to negotiate BOT contracts;

(f) Governments should be encouraged to strengthen the technology triangle at the national level, and to develop and utilize a similar approach at the international level. The concept of the technology triangle concern a public-private partnership that functions on the basis of strategic interaction and collaboration among government agencies and institutions, the private sector and institutions of science and technology. The objective is to stimulate the

development, transfer and diffusion of ESTs through collaborative partnerships and capacity-building.

Notes

1/ See document E/1994/33, chap. I, sect. C.

2/ "Lessons learned from the three information exchange networks to facilitate technology transfer", UNEP IE contribution submitted to the Workshop on the Promotion of Access to and Dissemination of Information on Environmentally Sound Technologies, hosted by the Government of the Republic of Korea, 30 November-2 December 1994.

3/ OECD secretariat, Background paper, Meeting of Experts on the Environment Industry (Paris, France, 13-14 October 1994), p. 22.

4/ Draft summary report, Third High-Level Advisory Seminar on Cleaner Production (Warsaw, Poland, 12-14 October 1994), p. 4.

5/ OECD, "The environment industry: issues for discussion", Directorate for Science, Technology and Industry, Industry Committee (Paris, France, 7 September 1994), p. 4.

6/ Chairman's summary, Round Table on the Transfer of Environmentally Sound Technology, Cooperation and Capacity-Building (Vienna, Austria, 6-8 February 1995), p. 3.

7/ "Transfer of environmentally sound technology, cooperation and capacity-building (informal submission from the OECD secretariat, Paris, France, 8 November 1994), p. 5.

8/ This observation is based on the contribution submitted by the United Nations Conference on Trade and Development (UNCTAD), Geneva, Switzerland, 15 December 1994.

9/ Background paper, Meeting of Experts on the Environment Industry, OECD secretariat (Paris, France, 13-14 October 1994), p. 22.

10/ Conference summary: International Business and Environmental Technology Cooperation (Washington, D.C., Center for Strategic and International Studies, 24 and 25 January 1994), p. 2 ff.

11/ Chairman's summary, Workshop on the Promotion of Access to and Dissemination of Information on Environmentally Sound Technologies (Seoul, Republic of Korea, 30 November-2 December 1994), p. 1.

12/ Report of the United Nations Conference on Environment and Development, Rio de Janeiro, 3-14 June 1992, vol. I, Resolutions Adopted by the Conference (United Nations publication, Sales No. E.93.I.8 and corrigendum), resolution 1, annex II.

13/ "Lessons learned from the three information exchange networks to facilitate technology transfer", UNEP IE contribution submitted to the Workshop on the Promotion of Access to and Dissemination of Information on Environmentally Sound Technologies, hosted by the Government of the Republic of Korea, 30 November-2 December 1994, p. 10 ff.

14/ Ibid., p. 23.

15/ OECD Workshop on Development Assistance and Technology Cooperation for Cleaner Production in Developing Countries, Hanover, Germany, 28-30 September 1994.

16/ "Proposed actions to promote the adoption of environmentally sound technologies through improved information exchange", prepared by UNEP Industry and Environment for the Workshop on the Promotion of Access to and Dissemination of Information on Environmentally Sound Technologies (Seoul, Korea, 30 November-2 December 1994), Paris, France, 25 November 1994, p. 3.

17/ "Proposal for Seoul plan of action, focus on small- and medium-scale industry (SMI)", UNIDO contribution to the Workshop on the Promotion of Access to and Dissemination of Information on Environmentally Sound Technologies (Seoul, Republic of Korea, 30 November-2 December 1994).

18/ Ibid.

19/ George R. Heaton, R. Darryl Banks, Jr. and Darryl D. Ditz, Missing Links: Technology and Environmental Improvement in the Industrializing World (Washington, D.C., World Resource Institute, 1994), p. xi.

20/ Based on information submitted by the Technology and Development Programme of the Massachusetts Institute of Technology (MIT) (Boston, Massachusetts, November 1994).

21/ Chairman's summary and Seoul Plan of Action concerning Information Exchange about Environmentally Sound Technologies, Workshop on the Promotion of Access to and Dissemination of Information on Environmentally Sound Technologies (Seoul, Republic of Korea, 30 November-2 December 1994).

22/ Chairman's summary and Elements of a Work Programme on Environmentally Sound Technology Transfer, Cooperation and Capacity-Building, Round Table on the Transfer of Environmentally Sound Technology, Cooperation and Capacity-Building (Vienna, Austria, 6-8 February 1995).

23/ Seoul Plan of Action concerning Information Exchange about Environmentally Sound Technologies, Workshop on the Promotion of Access to and Dissemination of Information on Environmentally Sound Technologies (Seoul, Republic of Korea, 30 November-2 December 1994).

24/ Chairman's summary and Elements of a Work Programme on Environmentally Sound Technology Transfer, Cooperation and Capacity-Building, Round Table on the Transfer of Environmentally Sound Technology, Cooperation and Capacity-Building (Vienna, Austria, 6-8 February 1995).

25/ OECD, Development Assistance Committee (DAC), "Effective technology transfer, cooperation and capacity-building for sustainable development: common reference paper" (OECD/GD/(94)12), 1994, p. 8.

26/ UNEP/IE, "Draft summary report", 1994 UNEP/IE Consultative Meeting with Industry/Trade Associations (Paris, France, 17 June 1994).

27/ Based on information submitted by the Regional Centre for Graduate Study and Research in Agriculture (SEARCA), 11 October 1994.

28/ Contribution submitted by the International Finance Corporation/World Bank Group (New York, 23 February 1995), p. 1.

29/ "Lessons learned from the three information exchange networks to facilitate technology transfer", UNEP IE contribution submitted to the Workshop on the Promotion of Access to and Dissemination of Information on Environmentally Sound Technologies, Seoul, Republic of Korea, 30 November-2 December 1994.

30/ Chairman's summary, Round Table on the Transfer of Environmentally Sound Technology, Cooperation and Capacity-Building (Vienna, Austria, 6-8 February 1995), p. 3, para. 9.

31/ Seoul Plan of Action, adopted at the Workshop on Promotion of Access to and Dissemination of Information on Environmentally Sound Technologies (Seoul, Republic of Korea, 30 November-2 December 1994), p. 3.

32/ Draft summary report, Third High-Level Advisory Seminar on Cleaner Production (Warsaw, Poland, 12-14 October 1994), p. 3.

33/ "Lessons learned form the three information exchange systems to facilitate technology transfer", contribution of UNEP IE to the Seoul Workshop (30 November-2 December 1994), p. 33.

34/ "On progress towards implementation of Agenda 21", report of the European Community submitted to the Commission on Sustainable Development, at its third session, April 1995, p. 12.

35/ Ibid., p. 13.

36/ OECD Directorate for Science, Technology and Industry, "Forum discussion on the environment industry" (Paris, France, OECD Industry Committee, 1 September 1994), p. 22, paras. 75-76.

37/ Chairman's summary and Elements of a Work Programme on Environmentally Sound Technology Transfer, Cooperation and Capacity-Building, Round Table on the Transfer of Environmentally Sound Technology, Cooperation and Capacity-Building (Vienna, Austria, 6-8 February 1995).

38/ Based on information prepared by the Delphi Group, on "Financing the transfer of environmentally sound technology", for the inter-sessional Ad Hoc Open-ended Working Group on Finance (1995).

39/ WICE Report on Technology Partnerships (Paris, France, World Industry Council for the Environment, 11 August 1994), p. 6.

40/ Chairman's summary and Elements of a Work Programme on Environmentally Sound Technology Transfer, Cooperation and Capacity-Building, Round Table on Environmentally Sound Technology, Cooperation and Capacity-Building (Vienna, Austria, 6-8 February 1995).

41/ This section is based on information excerpted from BOT Strategy. UNIDO Programme on Build-Operate-Transfer (Vienna, Austria, UNIDO, 1994).

42/ Private-Public Partnerships for Urban Environments, an initiative of UNDP, the Sustainable Project Management of the World Business Council for Sustainable Development and the Technology Development Program of the Massachusetts Institute of Technology (New York, UNDP, 1995).